

Wasted Capacity of Mexican *Ejidos* and Agrarian Communities to Mitigate Climate Change

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Climate change and the consequent global warming represent one of the greatest environmental threats on a planetary scale. Conservation of forest areas and their sustainable use are imperative to reduce greenhouse gas emissions, which are the main cause of the increase in the average temperature of the earth. In Mexico, forest ecosystems: forests, tropical rainforests and other areas with natural vegetation cover 70.5% of their surface, but 121 thousand hectares are deforested annually, so that at that rate by mid-century many forests and jungles will disappear. The *ejidos* and *agrarian communities*, a mode of land ownership only exists in Mexico, cover just over half of its territory and on its soils most of the wildlife, forest resources and hydrographic basins of the nation are located. So, it is essential to stop deterioration of these forests, to allow generating extensive environmental services. The vast majority of *ejidos* and *agrarian communities* have not had the resources to adequately take advantage of their wooded areas, when there is great potential to provide them with economic benefits, generate employment and, simultaneously, provide environmental services. The only thing that is required is government support so that they can make a sustainable use of them.

KEYWORDS: Biodiversity Conservation, Climate Change, *Ejidos* and *Agrarian Communities*, Environmental Services

INTRODUCTION

Human activities have substantially increased the concentrations of greenhouse gases in the atmosphere; this will result in additional warming of the Earth's surface and atmosphere, causing harmful variations in the physical environment and biota, which adversely affect ecosystems, health, and human well-being (NCHR 2020). The Convention on Climate Change (1992) recognized that the main sources of greenhouse gas (GHG) emissions are fossil fuel use, industrial activities and deforestation;

therefore, it was agreed to promote activities to reduce deforestation and degradation of the world's forests and jungles and to implement measures for the conservation and management of forest areas; in addition, to promote the sustainable use of forests, to reduce GHG emissions and thus contribute to curbing global warming and mitigating climate change.

Mexico is one of the 17 nations considered by the United Nations as Megadiverse Countries (Bertzky et

al., 2013), since due to the variety of climates and its complex orography, it is home to between 10 and 12% of the terrestrial species in 1.4% of the planetary surface (Semarnat, 2014), it is also the eleventh country in the world by the extension of its forests (FAO, 2015) and by its geographical location it has the four great forest ecosystems: forests, jungles, vegetation of arid zones and vegetation submerged in water (hydrophyte), which allows it to have one of the most varied flora and fauna of the planet.

The *ejidos* and *agrarian communities* (a form of land ownership exclusive to the country) cover almost 51% of the national territory and more than half of them are settled in areas of forests, jungles, or in lands with hydrophytic vegetation or plants from arid zones (INEGI, 2007; RAN, 2018), hence their potential to generate environmental services. However, the poverty in which their population lives, the low technology they possess, the lack of infrastructure, the change in land use (mainly from forest to cattle), illegal logging, pests, diseases and fires, and the negligible government support, have caused the deterioration, degradation and even extinction of some of these resources (INEGI, 2007; Semarnat, 2018; NFC, 2019); to the extent that between 2000 and 2015, 18,159 square kilometers of forest areas were lost, mainly due to clearing for agricultural activities, clandestine logging and intentional fires (Semarnat, 2019).

There is a gap in the body of knowledge on the subject, since studies have not taken into account that the *ejidos* and *agrarian communities* may be the most important pillar for generating environmental services in Mexico's forests and become the main element for slowing down climate change in the country. Therefore, the article is a contribution in the field of knowledge about forestry practiced by community enterprises. Therefore, the objective of the article is to explain that it is feasible for *ejidos* and *agrarian communities* with forest resources to have a high potential for carbon sequestration and capture, watershed regulation and biodiversity conservation, to contribute to climate change mitigation; as long as government policies for economic support, organization and training are directed at them.

There are many examples of *agrarian communities* and forest *ejidos* (in Mexican states of Campeche, Chiapas, Chihuahua, Guerrero, Jalisco, Nayarit, Oaxaca, Veracruz) that have demonstrated that sustainable and community-based management of forests and jungles is possible in Mexico, and it is feasible to extend these practices to a much larger

number of them if government support is available. The obstacle is that the Mexican government allocates only four percent of the agricultural sector budget to stimulate forestry activities (Report of the Presidency of the Republic of Mexico [PR], 2019), so it is imperative to increase government intervention to support community management of forests and jungles, stop deforestation, conserve biodiversity, sustainably use trees and other forest products, generate remunerative environmental services, and promote rural development. It is a major contradiction that the dominant economic pattern in Mexican agriculture is based on corporate agriculture that is primarily export-oriented, while the *ejidos* and *agrarian communities* are impoverished and living within an economic model in which they are marginalized and yet located in regions with very extensive natural resources and the nation's greatest biological diversity.

This exploratory study, utilising the quantitative research method, shows that more than 90% of *ejidos* and *agrarian communities* have the resources to preserve biodiversity, retain carbon and regulate aquifer recharge, and can therefore contribute to mitigating climate change.

MATERIALS AND METHODS

The method followed in the article is exploratory, as it utilises the quantitative research procedure whereby relevant literature, documents and records were conceptualized and analyzed in order to underscore wasted capacity of Mexican *ejidos* and *agrarian communities* to mitigate climate change. The study was based on my previous research (Morett-Sánchez and Cosío, 2017) and other authors (For example, Bautista-Hernández and Torres, 2003; Bray et al., 2007; Hodgdon et al., 2013; Madrid et al., 2009; Bunge, 2012; Torres-Rojas, 2015; Madrid et al., 2009; Merino, 2018; Zúñiga and Cervera, 2020) who have addressed the issue of Mexican *ejidos* and *agrarian communities* and sustainable forest use by their owners.

The materials from which the information was obtained were from international organizations such as the United Nations, FAO, the World Bank and the Inter-American Institute for Cooperation on Agriculture. In addition, data from Mexican government agencies was analyzed in reports from the National Institute of Ecology, the National Commission on Natural Protected Areas, the

National Forestry Commission, the National Commission for Knowledge and Use of Biodiversity, the National Institute of Ecology and Climate Change, the National Agrarian Registry and the Ministry of the Environment and Natural Resources. Also, we searched in the last censuses of the National Institute of Geography and Statistics (the agri-pecuary census, 2007; the *ejidal census*, 2007; and the National Household Survey, 2017 / 2018), and the reports of the Presidency of the Mexican Republic (2018 and 2019).

RESULTS

Decrease of Forests and Jungles in Mexico

One of the greatest environmental problems of the last decades has been the relentless loss of forests around the world. Mexico has not escaped this problem, ranking 17th in the world among the countries with the greatest deforestation and 5th in Latin America, (Global Forest Watch, 2020). The Mexican government reports that between 1993 and 2015 some seven million hectares of forest and jungle were lost (Semarnat, 2019); to the GFW (2020), by 2019 Mexico had lost almost four million hectares of the tree cover it had in 2000, which represents a decrease of 7.5 % from what existed at the beginning of this century. In the period 2000-2015 the net rate of deforestation was 121 thousand hectares per year (Semarnat, 2019); although by 2018 the GFW reported a loss in forest coverage, in the country of 267 thousand 731 hectares (GFW, 2020). At this rate (around 0.5% per year), in a few years many Mexican forests and jungles will have disappeared. In Mexico, the main causes of forest degradation and loss of vegetation cover are the expansion of agricultural activities (mainly livestock in what used to be forests), illegal logging and forest fires most of them intentional (Semarnat, 2018); In addition, overgrazing, pests and diseases, the extraction of forest soil, unsustainable management practices, and other changes in land use, such as the introduction of infrastructure, urban expansion, and activities such as open-pit mining (NFC, 2019).

Deforestation and the degradation of forest ecosystems cause erosion, sedimentation of lakes, rivers and dams, a decline in water catchment and groundwater recharge, flooding and soil loss. The reduction of forest areas not only has negative effects on the environment and biodiversity, but also leads to

the impoverishment, disintegration and even expulsion of human groups that have lived off the resources of forests and jungles since ancient times.

General Characteristics of the *Ejidos* and *Agrarian Communities*

Of the country's surface, 51% is owned by *ejidos* and *agrarian communities*, which make up the so-called *social property*, also known as *agrarian nuclei* (RAN, 2018), and they offer an important agricultural production and their soils are located most of the biodiversity, forests, jungles, grasslands, mangroves, coasts, agricultural surfaces and bodies of water (streams, rivers, lakes, mangroves and dams). The *ejidos* and *agrarian communities* are in the strict sense an organization (legal entity) composed of twenty or more Mexican citizens who own rural land (to whom the government has granted land, mountains, forests and water free of charge); and who dedicate themselves to developing mainly agricultural and forestry activities. The *ejidos* and *agrarian communities* are the result of a *sui generis* agrarian reform carried out between 1934 and 1992 and constitute land tenure modalities that only exist in Mexico (López-Bárceñas, 2017; Morett-Sánchez and Cosío, 2017). The 32,154 *ejidos* and *agrarian communities* are distributed throughout all the states that make up the country; there are 29,760 *ejidos* and 2,394 *agrarian communities* (RAN, 2019). In these places there are 5.6 million beneficiaries of the agrarian reform and they are called *ejidatarios* and *communal farmers* respectively.

The area that constitutes an *ejido* or *agrarian community* it is generally composed of three parts: for cultivation (individual plots); the land for common use (mountains, forests and jungles); and the area of the human settlement (where each member of the group has the right to a plot of land in private property to establish his or her home). Each *ejidatario* and *communal farmer* is the owner of his or her plot of land and co-owner of the other assets of the *ejido* or *agrarian community* (Agrarian Law, 2018). These forms of land tenure are not *cooperatives*, but rather something like the *condominium* regime. With respect to forestry activities, its members, unlike any other Mexican, cannot *individually own* forests and jungles, that is, their wooded areas are collectively owned.

In the *ejidos* and *agrarian communities*, 26 crops of economic relevance are planted and as far as cattle raising concerned, they are mainly dedicated to the

Table 1. General characteristics of the agricultural nuclei and their forestry activities.

| Item | Magnitude |
|--|---|
| Forest ecosystems | Cover 70.5% of the country's surface |
| Area of <i>ejidos</i> and <i>agrarian communities</i> | 51% of the national surface |
| Forests and jungles | 62% of them is in <i>ejidos</i> and <i>agrarian communities</i> |
| Flora of arid and semi-arid zones | 42.3% is in agrarian nuclei |
| Ejidos and communities that have two hundred or more hectares of forest | 48.5% |
| Agrarian nuclei with only forestry activities carried out by most of their members | 14% |
| Agrarian nuclei with forest transformation activities (40%) | Charcoal elaboration 50.5%, obtaining tables 26.3%, firewood exploitation 23.2% |
| Forestry agrarian nuclei with sawmill | 13.3% |

Source: Own elaboration with data from: Conafor 2019, INEGI 2007, RAN 2018, Semarnat 2018

breeding and milking of cattle. With respect to agriculture, seven out of every ten fields are corn fields, followed in importance by sugar cane, pasture and forage crops, coffee, fruit trees, vegetables and beans. The cultivation of pastures is destined to extensive and free-range livestock, mostly cattle and to a lesser extent sheep and goats.

Forestry Activities in *Ejidos* and *Agrarian Communities*

Mexico has an area of 137.8 million hectares with some type of coverage considered forest, the *agrarian communities* and *ejidos* have 62.6 million hectares of forests, jungles and forest vegetation in arid zones, which is equivalent to 45.4% of the country's forest area (NFC, 2019). However, if only talk about forests and jungles, it is estimated that 62% of them are found in *ejidos* and *agrarian communities* and 42.3% of the flora in arid and semi-arid zones would be in agrarian nuclei, with an average of 436.2 hectares of forest and jungle in each of them (Torres-Rojo, 2015; NCPNA, 2020; Zúñiga and Cervera, 2020), (Table 1).

By the type of vegetation on the social property 72% of the national area of thorny jungle is located, 67% of mesophilic mountain forest and sub-deciduous jungle, 66% of coniferous forest, 58% of cultivated forest, and 53% of oak forest (Torres-Rojo, 2015). In the forest areas of the *ejidos* and *agrarian communities* their owners extract wood for sale, also to make rustic furniture and for the walls and roofs of their houses. In addition, firewood is collected to be

used as fuel and for heating in homes; livestock is grazed, plants, fruits, mushrooms, tubers, edible pods and medicinal plants are collected; likewise, fibers are obtained to weave hats, rustic mats, baskets and chair seats; likewise, resins, hay, agaves (to make various alcoholic beverages) and palms. There are also activities for capturing live animals (mainly birds) and there is hunting and fishing, although with the passage of time on a smaller scale, due to the combination of overexploitation of fish and hunting pieces, with the negative effects of more than sixty years of applying the agrochemicals of the "Green Revolution" that has led to the disappearance of various wild animal species in many places.

According to the last Ejidal Census (INEGI, 2007), 2,207 of them have forestry activities carried out by most of their members, which would lead to consider that 14% are basically forestry. In these agrarian nuclei the forest exploitation is very elemental since only 889 of them (40%) have very rudimentary tree transformation activities, highlighting that 209 are only dedicated to the elaboration of charcoal, 109 to obtaining planks and 96 to the firewood collection (INEGI, 2009). There are 294 agricultural nuclei with sawmills, that is, 13.3%, which means that 87% of the *ejidos* and *forest communities* are dedicated only to cutting down trees, without any other transformation. In contrast, there are 590 privately owned sawmills, resulting that while more of 60% of the forests are in the agricultural nuclei, only a third of the country's sawmills are located there (INEGI, 2007, 2009). For the year 2010 (date of the last population census) in

the localities located in the country's forest areas, the population was estimated at 10.8 million people, of which almost a third (31.5%) are indigenous (NFC, 2019). These are human settlements with many shortages, to the extent that it is estimated that half of the inhabitants of these localities live in conditions of extreme poverty (Merino, 2014). Forest exploitation is costly, so even today in some of the poorest *ejidos* and *agrarian communities*, trees are still sold standing because their owners sometimes do not have the resources to even cut them down; Forestry requires large resources for plantations, machinery, equipment, roads, trucks and infrastructure, and it has very long cycles of recovery of investments, which is why the immense majority of *ejidos* and *agrarian communities*, throughout the process of agrarian reform, were unable to take full advantage of their wooded areas and had to grant concessions to individuals and parastatal companies until 1986 when a new Forestry Law prohibited it (Table 1).

DISCUSSION

Environmental Services: Potential of *Ejidos* and *Agrarian communities*

For the preservation and ecosystems care, there are three types of environmental services related to the natural resources of the *ejidos* and *agrarian communities*: biodiversity conservation, carbon reserves, and hydrological services. A study by the Inter-American Institute for Cooperation on Agriculture (IICA, 2012), which analyzed and related the quantity and type of vegetation, species richness and hydrological attributes of almost 70% of the country's agricultural areas, concluded that 94.3% of the surface area and 91.6% of the *ejidos* and *agrarian communities* are capable of providing some of the environmental services mentioned above. The same study also found that 89% of the agricultural nuclei and the surface area of social property have a medium to high level of potential for generating environmental services (IICA, 2012a).

There are 21,968 *ejidos* and *agrarian communities* (69%) that have some ecosystem that is valuable for the retention and capture of carbon: 9,165 have forests, 11,965 have rainforests and 6,144 have scrub. These agrarian nuclei have the capacity to retain carbon ranging from less than one ton to 19.2 million tons of carbon (Reyes et al., 2012).

As far as biodiversity conservation is concerned,

the National Commission for the Knowledge and Use of Biodiversity (NCKUB, n.d.) has identified 265 areas in Mexico that stand out for their rich ecosystems, comparatively larger than in the rest of the country, and which also have a high potential for conservation; these areas are classified as Priority Terrestrial Regions (152) and Priority Hydrological Regions (111), with the characteristic that in all of them there are *ejidos* and *agrarian communities*. Thus, half of the Priority Terrestrial Regions are in 6,592 agricultural nuclei and cover 25.7 million hectares; while 12,717 *ejidos* and *agrarian communities*, with 38.7 million hectares, represent 48% of the Hydrological Regions (IICA, 2012). To measure the importance that these environmental services can have on social property, one must consider that there are 15,584 *ejidos* and *agrarian communities* that can be classified as having forest potential, since half of their surface area is forested, resulting in an area of 62.6 million hectares; another more conservative criterion considers only agrarian nuclei with at least 200 hectares of forest, jungle and scrubland, resulting in an area of 57.3 million hectares (Reyes et al., 2012). In any case, the surface area is enormous (the lower end represents a larger area than the whole of Spain) and the possibilities of providing environmental services are very large. According to Bautista-Hernández and Torres (2003), one hectare of tropical forest generates an average of 353.3 tons of carbon; likewise, using the calculations of Rodríguez-Larramendi et al. (2016), it is concluded that the *ejidos* and *agrarian communities* originate at least 7 billion tons of carbon annually (Table 2).

Government Support for the Efficient Management of Forest *Ejidos* and *Agrarian Communities*

Government aid for the forestry sector in Mexico has always been limited. The budget channeled to forestry has represented about one percent of public resources for the agricultural sector. The government has prioritized crops over the utilization of forest resources, which has been a determining factor in decisions to cut down forests and jungles. In addition, a large part of the resources for the forestry sector are allocated to limited reforestation programs, fire-fighting programs and studies on the sector, compared to the resources directed to sustainable forest management programs (NFC, 2019). Currently in Mexico, policies aimed at adequate forest

Table 2. Environmental services and community forestry in ejidos and agrarian communities.

| Item | Magnitude |
|---|---|
| Possibility of offering some environmental service | In 94.3 % of the surface and in 91.6 % of the <i>ejidos</i> and <i>agrarian communities</i> |
| 69% of the <i>ejidos</i> and <i>agrarian communities</i> have some valuable ecosystem for the retention and capture of carbon | With jungles 30.3%, forests 23.2%, scrubs, 15.5% |
| Biodiversity Conservation Potential | Half of the country's Priority Terrestrial Regions are in agricultural nuclei and cover 25.7 million ha |
| Potential for hydrological services | 39.6% of the <i>ejidos</i> and <i>agrarian communities</i> , with 38.7 million ha, represent almost half of Mexico's hydrological regions; and almost all the country's potential water reserves are in 7,462 agricultural nuclei, with 23.4 million ha |
| Carbon supply | <i>Ejidos</i> and <i>agrarian communities</i> originate at least at least 7 billion tons of carbon annually |
| Agrarian communities and ejidos that use their forests as a community | 2,843 in an extension of 4.4 million ha |

Source: Own elaboration with data from: Bautista y Torres, 2003; CCMSS, 2016; GFW, 2020; IICA, 2012; INEGI, 2007; RAN, 2018; Reyes, 2012; Torres-Rojo, 2015; and Zúñiga, 2020.

management and sustainability are deficient and limited, seeming to be a catalog of good wishes, since the objectives are very broad and very difficult to achieve, because they are incongruent with the scarce government support directed at the forest sector, which for the year 2018 was 0.5% of the country's agricultural budget and the actions aimed at protecting biodiversity and natural heritage by the *ejidos* and *Agrarian communities* only reached 0.1% (PR, 2019).

Community Management of Forests and Jungles as an Alternative for Forestry

In Mexico, the legal and institutional framework has changed from a model of exploiting the forests and jungles of the *ejidos* and *agrarian communities* through concessions to private and parastatal companies, to community forestry. The 1986 Forestry Law annulled forestry concessions to private and public companies and recognized the right of communities to directly exploit their wooded areas, while outlawing the "Forest Rental" rights. This was the basis for the emergence of today's community forestry management (FAO, n.d.). As part of a *sui generis* agrarian reform, the Mexican State, with the 1940 Forestry Law, assumed the authority to grant

the exploitation of forest resources in the *ejidos* and *agrarian communities* to private companies. Faced with the need for forest products necessary for industrial growth, the government, instead of providing economic and technical support to the agrarian nuclei to exploit their forests and jungles, opted to allow their exploitation, through concessions, to large companies. This was legally permitted, but in many *ejidos* and *agrarian communities* they granted their forests informally to private entrepreneurs, who had the resources to exploit them in exchange for a fee. The workers in the tree extraction areas or in the private sawmills were generally the same *ejidatarios* or *agrarian* farmers and their families. Thus, the benefit of the concessions (legal and illegal) was a small income and some precarious employment.

The government granted concessions to private companies for about 12 million hectares in the richest forests of several states in the republic. The average duration of the concessions was 25 years, although in some cases the terms were up to 60 years. The private companies imposed severe restrictions on the use of their own forests and jungles by the agrarian nuclei. The *ejidatarios* and *agrarian* farmers could only sell wood to the concessionaires, while the collection of forest resources for domestic use and

the practice of traditional itinerant agriculture (slash and burn) were prohibited. In exchange for the concessions, the communities and *ejidos* received an income, known as the "Mountain Rights" which was fixed by the agrarian authorities and generally represented no more than 5% of what was taken from the companies. These resources were not given by the companies directly to the *ejidatarios* and *agrarian communities* farmers, but rather to the government, which constituted a fund with them, the amounts of which could only be invested in productive projects in the communities, as long as they were approved by the governmental Agrarian Department (NIECC, n.d.).

The forest concessions generated little regional development; the industries were decapitalizing, and social benefits were very limited. The profits of the parastatal companies were invested in the priorities of the federal government, most often outside the forest regions.

In the forest exploitation of the agrarian nuclei, a vicious circle was formed, since when operating in many parts concessions - formal and informal - initially to private companies and later in the seventies to parastatal companies, because they were limited in time, they did not stimulated the existence of important private or even public investments, which were nor responsible for reforestation. The concessions became licenses to clear forest areas. The immoderate logging, without planning and without reinvestment, caused the Mexican forestry sector to never consolidate and to register in the country a chronic deficit of forest products and a deficit trade balance that between 2013 and 2017 reached an average of more than six billion dollars per year (Semarnat, 2018).

Community forest management, which began to gain momentum in the late 1980s, is a model of forest administration undertaken by various agrarian communities and *ejidos* that, taking advantage of changes in the Forestry Law, began to develop management programs for the sustainable use of their forest resources.

Several studies (Madrid et al., 2009; Merino and Martínez, 2014; Merino, 2018; Reyes et al., 2012; Valdés and Negreros-Castillo, 2010; Vázquez, 2015) have contributed to demonstrate the potential that community management has for the rational use of forests and the generation of environmental services; furthermore, organized forest communities and *ejidos* have proved that the forest management they have been carrying out for more than 25 years is

done with sustainable practices and that it constitutes a viable alternative for their economic development which also generates a series of social benefits. As a result, Mexico is now the country with the largest area of forest under community management in the: "In global terms, this is a pioneering experience and, although it is little known and valued in the country itself, it has been considered a model and replicated in other latitudes" (Merino, 2014).

Currently, 2,843 *agrarian communities* and *ejidos* use their forests in a community manner in an extension of 4.4 million hectares (CCMSS, 2016); of these 280 have made considerable progress in the forestry, environmental, social and economic aspects, until obtaining certification in forest management under one of the three recognized schemes in Mexico: the Preventive Technical Audits (ATP) and the Sustainable Forest Certification (officially named: NMX-AA-143-SCFI, 2008) which are granted by the Mexican government; and the international certification of the Forest Stewardship Council (FSC) (NFC, 2019). The 280 *ejidos* and communities mentioned have 2.46 million certified hectares (NFC, 2019), a very important amount since it represents 47% of the forest area in social ownership (Table 2).

The community forestry companies, in addition to providing monetary income to their members and generating around 138,000 jobs (CCMSS, 2016), have also had positive effects on their localities and have contributed to the strengthening of cooperative ties among their members. There are experiences in which part of the profits of forest enterprises, "... are very often invested in the development of urban infrastructure and services in forest villages. This investment is especially important in regions that, like forest areas, tend to be highly marginalized (Merino, 2014). Community management has shown that far from leading to the deterioration of forests, it contributes to their conservation. A notable example is that: the largest and best preserved area of mesophilic forests in the country is found in community conservation areas in the state of Oaxaca (Merino, 2014). In addition, researchers Merino and Martínez (2014) found that, in almost half of the 103 *ejidos* and *agrarian communities* they studied, some areas had been set aside exclusively for the protection of forest systems, that is, progress steps were being taken toward sustainability in a considerable number of agrarian nuclei.

Community forest management is a viable mitigation strategy (based on adaptive capacities)

and maintains tree cover; it is also compatible with payment for environmental services schemes and can capture greater volumes of carbon, considering that the carbon in the wood that is extracted is generally not immediately emitted into the atmosphere and is kept captured in the products made from it (Merino, 2014).

The collective ownership of forests and jungles in Mexico's *ejidos* and *agrarian communities* allows for largescale planning, with impacts on vast areas of the country. Because, "... decisions on the use of territory are not made in small plots or around particular interests but in accordance with collective decisions involving large areas of land. In this way, more orderly landscapes can be guaranteed with the conservation of extensive forest massifs and the formation of biological corridors. This makes conservation efforts more effective" (Madrid et al., 2009).

In summary, forests under community management have positive effects on nature and society. They have the capacity to contribute to the mitigation of climate change, contribute to the preservation of biodiversity, carbon capture, temper global warming, and maintain the water cycle; in addition, they have the possibility of providing environmental and hydrological services. In addition, they have the possibility of providing environmental and hydrological services, while in the social field they generate employment and income, mitigate migration and promote the development of organizational capacities and the strengthening of cooperation and solidarity networks.

CONCLUSION

Mexico is one of the countries with the greatest biological and ecosystem diversity; however, many species and environments are endangered due to inadequate exploitation. About the vulnerability of terrestrial ecosystems, if deforestation is not stopped, more than 171,000 hectares per year will be lost. By 2050 there will be almost no tropical forests left in the country and many of the temperate forests will have disappeared. The loss of forest areas has enormous negative effects on the environment and leads to the impoverishment and even expulsion of human groups that inhabit the forests and jungles. Four-fifths of Mexico's biodiversity and natural wealth are in socially owned territories, since 85% of the *ejidos* and *agrarian communities* have some valuable

ecosystem for carbon retention and capture, of at least 7 billion tons of carbon annually. Also, half of the country's Priority Land Regions are also located in agrarian nuclei; while 12,717 *ejidos* and *agrarian communities* represent almost half of the Hydrological Regions; and almost all the country's Potential Water Reserves are in 7,462 agrarian nuclei. The surface area is enormous, so Mexico's *ejidos* and *agrarian communities* have great potential to preserve biodiversity, carry out sustainable forest management, capture carbon, generate environmental services and, with all this, contribute to mitigating global warming.

Mexico is the country with the largest area of forest under community management in the world. The organized *forest communities* and *ejidos* have shown that the forest management they have been carrying out for more than 25 years is carried out with sustainable practices and that it constitutes a viable alternative for their economic development, which also generates a series of social benefits and enhances local development. Advances in conservation and in the generation of environmental services in *ejidos* and *agrarian communities* are quite significant; it represents nowadays almost half of the forest area of social property. In several *ejidos* and *agrarian communities* that exploit their forests communally, it has been shown that they carry out good forestry practices; so that 280 of them have obtained sustainable forest management certifications in almost two and a half million hectares.

The community forestry enterprises, in addition to generating employment and monetary income for their members, have also had a positive impact on their villages and have contributed to the strengthening of cooperative ties between their members. There are experiences that some of the resources of forestry companies have been used for infrastructure works and urban services in their human settlements. These investments are particularly important, as forest regions are often highly marginalized and lack public services. Forests managed by *ejidos* and *agrarian communities* are more stable systems than those based on environmental rents, and community forest production creates long-term incentives for forest conservation by reducing migration and generating employment, income, and sometimes even investment in community public goods and services. Forest community management has shown, with several examples, that far from leading to the

deterioration of Mexico's forests and jungles, it contributes to their conservation. The collective ownership of forests and jungles by *ejidos* and *agrarian communities* allows for large-scale planning, with effects on wide areas of the country, since land use agreements are assumed collectively and therefore have an impact on large areas of land. This makes conservation efforts more effective because fragmentation is reduced, vast forests areas can be conserved, and biological corridors are safeguarded. Community-managed forests and jungles have several positive ecological, economic, and social effects that promote local development. They have the potential to contribute to climate change mitigation, contribute to the preservation of biodiversity, carbon sequestration, maintenance of the water cycle, and mitigation of global warming. In the social sphere, they generate employment and income, mitigate migration, and promote the expansion of organizational capacities and the strengthening of cooperation and solidarity networks. For forest areas to be conserved and generate major environmental and social benefits, a complete change in the Mexican government's policy towards the forest sector is required, and support must be provided mainly to *ejidos* and *forest agrarian communities*.

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